

(12) UK Patent Application (19) GB (11) 2 198 037 (13) A

(43) Application published 8 Jun 1988

(21) Application No 8726647

(22) Date of filing 13 Nov 1987

(30) Priority data

(31) 61/174288 (32) 13 Nov 1986 (33) JP

(51) INT CL
A46B 11/02

(52) Domestic classification (Edition J):
A4K 157 158 167 175 BA
U1S 1120 1124 2258 A4K

(56) Documents cited
None

(58) Field of search
A4K
Selected US specifications from IPC sub-class
A46B

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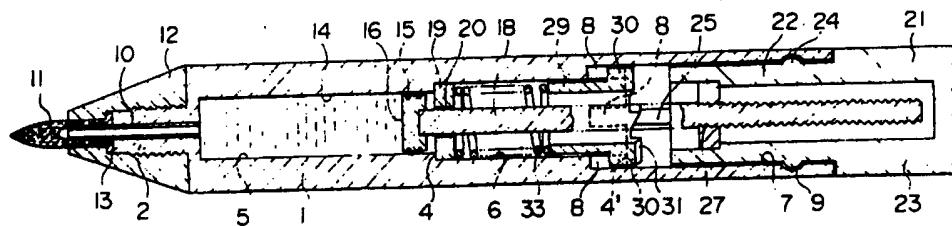
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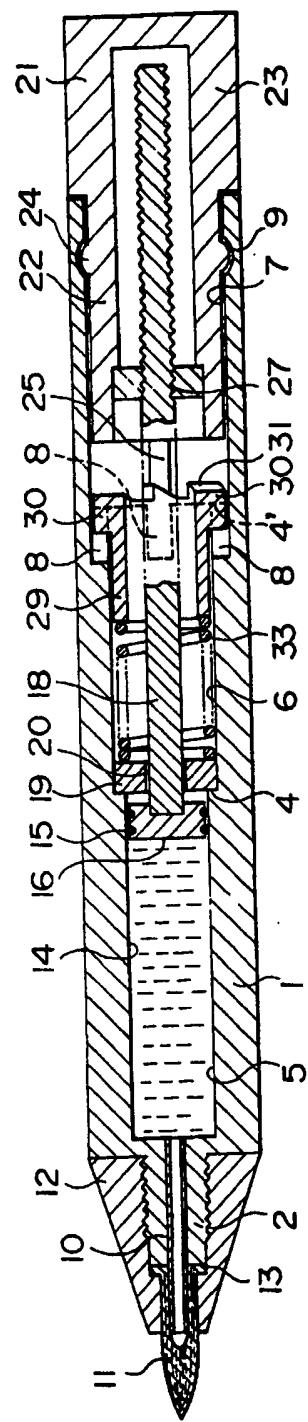
(54) Liquid applicator

(57) A liquid applicator such as a cosmetic writing or like instrument is provided with a piston 16 for forcibly feeding application liquid to a liquid application member 11 from a liquid reservoir 14. The piston is fixedly mounted to a front end of a threaded rod 18 and is axially advanced by the threaded rod when the latter is rotatably driven by the user by means of a rotary control sleeve 21 provided in a rear end of the applicator. When the control sleeve is rotated, a rigid cam projection 25 provided in a front-end surface of the control sleeve acts as a detent with respect to a cylindrical cam follower 29 urged resiliently against the cam projection and produces a click each time the cam projection passes a rear-end projection 31 of the cam follower; the rotary control sleeve is rotatable in only a single direction and axial movement thereof is prevented by ridge 24 which engages groove 9 of shaft sleeve 1.



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LIQUID APPLICATOR

5 The present invention relates to a liquid applicator such as: cosmetic instruments employing cosmetic liquid such as an eyeliner, mascara, nail polish and the like; writing instruments employing ink such as a marking pen, felt-tipped pen and the like; and other 10 applicator for applying other application liquid, and more particularly to a liquid applicator for forcibly feed the application liquid to a liquid-application portion of the instrument.

15 Hitherto, there has been provided a liquid applicator in which: a reservoir portion for receiving the application liquid therein is provided in the interior of a shaft sleeve of the applicator, the reservoir portion communicating with the liquid-application portion of 20 the applicator; an axially-movable member such as a piston is mounted in the reservoir portion of the applicator; a rotary control member is provided in a rear-end portion of the shaft sleeve of the applicator, and rotatably driven to move the axially-movable member such as the 25 piston forward in a screw-driving manner so that the

1 application liquid is forcibly fed to the liquid-
application portion from the reservoir portion of the
applicator. Such conventional liquid applicator is dis-
closed in, for example, Japanese Utility Model Publication
5 No. 50-10925.

In such conventional liquid applicator, however,
in case that it is necessary to keep a feed rate of the
application liquid at a certain level, namely, in case
that the axially-movable member such as the piston of
the applicator is advanced at a certain rate, it is neces-
10 sary to precisely control the rotary control member of
the applicator in its rotation. However, it is very cum-
bersome for the user to precisely control the rotary
control member of the applicator even when a graduated
scale is provided in a rotary knob of the rotary control
15 member of the applicator, because the reading of such
scale makes the user tired and leads to misreading. Such
misreading often causes the rotary control member to
be reversely rotated so that air is sucked into the reser-
voir portion of the applicator and expanded when the
20 temperature of the applicator increases. Such expansion
of the air in the reservoir portion causes the application
liquid to drop from the liquid-application member of
the applicator. These are problems inherent in the conven-
25 tional liquid applicator. Therefore,

1 the present invention provides a novel liquid applicator which may resolve the above problems.

5 The present invention provides a novel liquid applicator such as cosmetic instru-
10 ments, writing instruments and like instruments comprising: a tubular shaft sleeve; a liquid-application member connected to a front-end portion of said shaft sleeve; a liquid reservoir portion communicating with said liquid-application member, said reservoir portion being provided in said shaft sleeve; a piston provided in said reservoir portion so as to be axially slidable while brought into a watertight contact with said reservoir portion; a threaded rod connected to said piston, said threaded
15 rod being provided with a screw portion at least in its rear portion; a stopper means for preventing said threaded rod from rotating; a rotary control sleeve rotatably mounted in a rear-end portion of said shaft sleeve in an insertion manner, said rotary control sleeve being prevented from moving in an axial direction of said shaft sleeve while provided with a rigid cam projection having an oblique front-end surface; a cylindrical cam follower interposed between said liquid reservoir portion and said rotary control sleeve, said cylindrical cam follower being provided with a rear-end projection consisting

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1 of a vertical wall extending substantially parallel to
a longitudinal axis direction of said shaft sleeve and
an oblique wall obliquing from said vertical wall at
a sharp angle, said cylindrical cam follower being engaged
5 with said cam projection of said rotary control sleeve;
a guide means for guiding said cylindrical cam follower
which is prevented from rotating about its longitudinal
axis by said guide means which permits said cylindrical
cam follower to move in a longitudinal direction of said
10 shaft sleeve, said guide means being constructed of its
components which are provided in both an inner wall of
said shaft sleeve and said cylindrical cam follower;
a coil spring for always urging said cam follower rear-
ward, said coil spring being provided in a position in
15 front of said cylindrical cam follower; and a driving
means for driving said threaded rod, said driving means
being provided inside said rotary control sleeve.

In the liquid applicator of the present invention,
it is possible to provide a plurality of the rear-end
projections of the cylindrical cam follower and a plural-
20 ity of the cam projections.

The driving means for driving the threaded rod
of the applicator of the present invention may be a
threaded hole provided inside the rotary control sleeve,
25 or may be a separate member provided with a female screw

1 which is positioned in a central portion of the separate member and meshes with the threaded portion of the threaded rod, the separate member being fixed to the rotary control sleeve inside the same.

5 It is preferable that the guide means for guiding the cylindrical cam follower is constructed of: a groove provided in an inner wall of the shaft sleeve; and a projection provided in an outer peripheral surface of the cylindrical cam follower, or constructed of: a projection provided in the inner wall of the shaft sleeve; and a groove provided in the outer peripheral surface of the cylindrical cam follower.

15 The drawing shows a longitudinal sectional view of an embodiment of the liquid applicator of the present invention.

20 Hereinbelow, an eyeliner, which is an embodiment of the liquid applicator of the present invention, will be described in detail with reference to the drawing.

As shown in the drawing, the reference numeral 1 denotes a tubular shaft sleeve of the liquid applicator of the present invention. In a front-end portion of the shaft sleeve 1 of the applicator, there is provided a small-diameter projection 2 to a front-end portion of

1 which is connected a brush tip 11 which is provided with
a rear-end flange 13 in its base portion. A front shaft
12 is threadably connected to the small-diameter projec-
tion 2 of the shaft sleeve 1 through the rear-end flange
5 13 of the brush tip 11 so as to fix the brush tip 11
to the shaft sleeve 1.

The reference numeral 10 denotes a liquid conduit
through which a liquid reservoir portion 14 of the shaft
sleeve for receiving an application liquid therein commu-
nicates with the brush tip 11. The liquid conduit 10
10 is fixedly mounted in a bore portion of the small-diameter
projection 2 of the shaft sleeve 1 in an insertion manner
so that a front-end portion of the liquid conduit 10
projects outward from the front end of the small-diameter
projection 2 of the shaft sleeve 1 to enter the interior
15 of the brush tip 11 at its front-end portion.

The brush tip 11 communicates with the liquid
reservoir portion 14 of the shaft sleeve 1 through such
liquid conduit 10, so that the application liquid is
fed to the brush tip 11 from the liquid reservoir portion
20 14 of the shaft sleeve 1 through the liquid conduit 10.

The interior of the tubular shaft sleeve 1 in-
creases stepwise in its inner diameter to form: a first
interior part forming the bore of the small-diameter
projection 2; a second interior part 5 which is positioned
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1 behind the first interior part and larger in diameter
than the first interior part or the bore of the small-
diameter projection 2, and forms the liquid reservoir
portion 14 of the shaft sleeve 1; a third interior part
5 6 which is positioned behind the second interior part
5 and larger in diameter than the second interior part;
and a fourth interior part 7 which is positioned behind
the third interior part 6 and larger than the third inter-
ior part 6. Shoulder portions 4 and 4' are formed in
10 a position between the second 5 and the third 6 interior
parts and in a position between the third 6 and the fourth
7 interior parts, respectively.

A plurality of guide grooves 8, which open into
the shoulder portion 4' of the shaft sleeve 1, are pro-
15 vided in an inner wall of a rear-half portion of the
third interior part 6 of the shaft sleeve 1 at interval
of a certain distance in a circumferential direction
of the shaft sleeve 1, which guide grooves 8 extend in
a longitudinal direction of the shaft sleeve 1.

20 A cam projection 25, which is provided with an
oblique surface in its front end, is provided in a prede-
termined position of a circumferential portion of a
front-end surface of the rotary control sleeve 21 in
a projecting manner.

25 The reference numeral 29 denotes a cylindrical

1 cam follower provided in a position in front of the rotary
control sleeve 21. In an outer peripheral surface of
a rear-end portion of the cylindrical cam follower 29,
there are provided a plurality of elongated projections
5 30, which extend in a longitudinal direction of the shaft
sleeve 1, at positions corresponding to those of the
guide grooves 8 of the shaft sleeve 1. It is not necessar-
ily required that the number of the projections 30 corre-
spond to that of the guide grooves 8. The number of the
10 projections 30 may be smaller than that of the guide
grooves 8. The guide grooves 8 cooperate with the projec-
tions 30 in guiding the cylindrical cam follower 29.
Alternatively, it is also possible to provide the projec-
tions 30 in the inner wall of the shaft sleeve 1, and
15 the guide grooves 8 in the outer peripheral surface of
the cylindrical cam follower 29.

The plurality of the projections 30, which are
equally spaced from each other in a circumferential direc-
tion of the cylindrical cam follower 29, are provided
20 in a rear-end surface of the cylindrical cam follower
29, each of which projections 30 is constructed of: a
vertical wall extending substantially parallel to a longi-
tudinal axis of the shaft sleeve 1; and an oblique wall
obliquing from the vertical wall at a sharp angle. An
outer diameter of the cylindrical cam follower 29 is
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1 so determined that the cylindrical cam follower 29 is
snugly inserted into the third interior part 6 of the
shaft sleeve 1. At this time, the projections 30 of the
cylindrical cam follower 29 are inserted into the guide
5 grooves 8 of the shaft sleeve 1. Consequently, the shaft
sleeve 1 prevents the cylindrical cam follower 29 from
rotating about its longitudinal axis, but permits the
cylindrical cam follower 29 to move in a longitudinal
direction of the shaft sleeve 29.

10 A coil spring 33 is interposed between the cylindrical cam follower 29 and a stopper means 19 for preventing the threaded rod from rotating about its longitudinal axis, so that the cylindrical cam follower 29 is urged rearward under the influence of a resilient force of
15 the coil spring 33, whereby the projections 30 of the cylindrical cam follower 29 are always engaged with the cam projection 25 of the rotary control sleeve 21.

20 A groove 9 is provided in an inner wall of the shaft sleeve 1 at a position near the rear end of shaft sleeve 1 to extend in a circumferential direction of the inner wall of the shaft sleeve 1.

25 A piston 16 is axially slidably inserted into the liquid reservoir portion 14 of the shaft sleeve 1. The application liquid is received in the liquid reservoir portion 14 at a position in front of the piston 16.

1 O-rings 15 are mounted on an outer peripheral surface
of the piston 16 so that the piston 16 is brought into
a watertight contact with an inner surface of the liquid
reservoir portion 14 through the O-rings 15 to prevent
5 the application liquid from leaking from the liquid reservoir
portion 14. It is possible to replace the O-rings
15 with any other suitable means for preventing the appli-
cation liquid from leaking from the liquid reservoir
portion 14.

10 A threaded rod 18 is fixed to a rear side of
the piston 16, and passes through the third interior
part 6 of the shaft sleeve 1 to enter the fourth interior
part 7 of the shaft sleeve 1. A rear-half portion of
15 the threaded rod 18 forms a male screw, while a front-half
portion of the threaded rod 18 is not threaded to form
a square-column portion.

It is possible that the threaded rod 18 assumes
a square-column shape as a whole. In this case, longitudi-
nal edges of such square-column-shaped rod 18 is threaded.

20 It is also possible that the threaded rod 18
assumes a circular-column shape as a whole.

The reference numeral 19 denotes a stopper means
for preventing the threaded rod 18 from rotating about
its longitudinal axis, provided that the stopper means
25 19 permits the threaded rod 18 to move axially relative

1 to the shaft sleeve 1.

The stopper means 19 is provided with a central hole 20 a shape of which corresponds to that of the cross section of the front-half portion of the threaded rod 18, so that the threaded rod 18 is slidably inserted 5 into the central hole 20 of the stopper means 19. Consequently, it is possible for the threaded rod 18 to axially move relative to the stopper means 19, but not possible to rotate about its longitudinal axis. In case that 10 the threaded rod 18 assumes a circular-column shape as a whole, another stopper means is required. For example, a ridge extending in a longitudinal direction of the shaft sleeve 1 is integrally formed in an outer peripheral surface of such threaded rod 18 to provide such another 15 stopper means, provided that the central hole 20 assumes a shape corresponding to a cross section of such threaded rod 18 having the ridge.

The reference numeral 21 denotes a rotary control sleeve a front-half portion 22 of which is rotatably mounted in the fourth interior part 7 of the shaft sleeve 1. An outer diameter of the front-half portion 22 of 20 the rotary control sleeve 21 is slightly smaller than the inner diameter of the fourth interior part 7 of the shaft sleeve 1 to make it possible that the front-half portion 22 of the rotary control sleeve 21 fits in the 25

1 fourth interior part 7 of the shaft sleeve 1. An outer
diameter of a rear-half portion 23 of the rotary control
sleeve 21 is substantially corresponding to the outer
diameter of the rear-end portion of the shaft sleeve

5 1.

An annular ridge 24 corresponding to the groove
9 of the shaft sleeve 1 is provided in the outer periph-
eral surface of the front-half portion 22 of the rotary
control sleeve 21 at a position corresponding to that
of groove 9 when the rotary control sleeve 21 is mounted
in the fourth interior part 7 of the shaft sleeve 1.
Such ridge 24 of the rotary control sleeve 21 engages
with the groove 9 of the shaft sleeve 1 so that the rotary
control sleeve 21 is rotatably mounted in the rear-end
portion of the shaft sleeve 1, while prevented from moving
axially.

The cam projection 25, which is rigid, is provided
in the front-end surface of the rotary control sleeve
21. A front end of the cam projection 25 is defined by
20 the oblique wall, so that the cam projection 25 assumes
a trapezoid shape as a whole. In the embodiment of the
present invention shown in the drawing, the number of
the cam projection 25 is single. However, it is also
possible to provide a plurality of the cam projections
25 in the rotary control sleeve 21. In a condition in

1 which the rotary control sleeve 21 is mounted in the
shaft sleeve 1, the front-end portion of the cam projec-
tion 25 engages with a rear-end projection 31 of the
cylindrical cam follower 29. In a rear-end view of the
5 liquid applicator shown in the drawing, when the user
rotates the rotary control sleeve 21, the rotary control
sleeve 21 can rotate counterclockwise since the cylindri-
cal cam follower 29 is moved forward against the resilient
force of a coil spring 33 by the rigid cam projection
10 25 which, at this time, abuts on the oblique wall of
the rear-end projection 31 of the cylindrical cam follower
29 to urge the same 29 forward. In contrast with this,
it is not possible for the user to rotate the rotary
control sleeve 21 clockwise in the rear-end view of the
15 liquid applicator shown in the drawing since the rigid
cam projection 25 of the rotary control sleeve 21 abuts
on the vertical wall of the rear-end projection 31 of
the cylindrical cam follower 29 to act as a detent. Conse-
quently, as is clear from the above description, it is
20 possible for the user to rotate the rotary control sleeve
21 counterclockwise only in the rear-end view of the
liquid applicator shown in the drawing. During the rota-
tional operation of the rotary control sleeve 21, a click
is produced at each time when the rigid cam projection
25 of the rotary control sleeve 21 passes the rear-end

1 projection 31 of the cylindrical cam follower 29, because
the rigid cam projection 25 of the rotary control sleeve
21 is hit with a flat rear-end surface of the cylindrical
cam follower 29 under the influence of the resilient
force of the coil spring 33 after the rear-end projection
5 31 of the cylindrical cam follower 29 is moved forward
against the resilient force of the coil spring 33 to
pass the rigid cam projection 25 of the rotary control
sleeve 21.

10 Inside the rotary control sleeve 21 is provided
a driving member 27 which is fixedly mounted in the rotary
control sleeve 21 while provided with a female screw
in its central portion, which female screw is threadably
engaged with the threaded portion of the threaded rod
15 18. The driving member 27 may be fixed to the rotary
control sleeve 21 by means of a suitable means. It is
also possible to replace such separate driving means
27 with a threaded hole formed in the rotary control
sleeve 21.

20 The threaded portion or a male screw portion
of the threaded rod 18 is threadably engaged with the
female screw of the driving member 27 and moves the
threaded rod 18 forward when the rotary control sleeve
21 is rotated by the user in the single direction men-
25 tioned above.

1 The threaded rod 18 has a sufficient length so
that it is possible to move the piston 16 to the foremost
position of the liquid reservoir portion 14 of the shaft
sleeve 1.

5 The above components of the liquid applicator
of the present invention may be made of conventional
materials. It is also possible to cover the brush tip
11 with a cap (not shown) in order to protect the brush
tip 11 from damage.

10 In operation, the rotary control sleeve 21 is
rotated by the user so that the piston 16 is moved forward
by the threaded rod 18. Under such circumstances, since
the rotary control sleeve 21 is kept stationary in the
axial direction of the shaft sleeve 1, the cylindrical
cam follower 29 is moved forward against the resilient
force of the coil spring 33 by the rigid cam projection
25 of the rotary control sleeve 21 and returns to its
initial position when the rear-end projection 31 thereof
passes the rigid cam projection 25 of the rotary control
sleeve 21 to hit the rigid cam projection 25, whereby
20 the click is produced at each time when the rear-end
projection 31 of the cylindrical cam follower 29 passes
the rigid cam projection 25 of the rotary control sleeve
21.

25 In use, it is possible for the user to sense

1 the thus produced click in hearing and feeling. Conse-
quently, it is very easy for the user to control the
rotary control sleeve 21 in feeding the application liquid
to the brush tip 11 from the liquid reservoir portion
5 14 by the use of the piston 16.

In this case, since there is no fear that the
rotary control sleeve 21 is reversely rotated, there
is no fear that the piston is moved rearward to cause
the air to enter the liquid reservoir portion 14 of the
10 shaft sleeve 1.

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CLAIMS

1. A liquid applicator comprising:
 - a tubular shaft sleeve;
 - 5 a liquid-application member at a front-end portion of said shaft sleeve;
 - a liquid reservoir portion communicating with said liquid-application member, said reservoir portion being provided in said shaft sleeve;
 - 10 a piston in said reservoir portion so as to be axially slidable while in sealing contact with said reservoir portion;
 - a threaded rod connected to said piston, said threaded rod being provided with a screw portion at least at its rear portion;
 - means for preventing said threaded rod from rotating;
 - 15 a rotary control sleeve rotatably mounted at a rear-end portion of said shaft sleeve, said rotary control sleeve being prevented from moving in an axial direction of said shaft sleeve, and having at least one rigid cam projection with an oblique front-end surface;
 - a cylindrical cam follower interposed between said liquid reservoir portion and said rotary control sleeve, said cylindrical cam follower having a rear-end projection comprising a perpendicular wall extending substantially parallel to the longitudinal axis of said shaft sleeve and an oblique wall extending from said perpendicular wall at an acute angle, said cylindrical cam follower engaging with said cam projection of
 - 20 said rotary control sleeve;
 - 25

1 a guide means for guiding said cylindrical cam follower which
is prevented from rotating about its longitudinal axis by said guide means
and which permits said cylindrical cam follower to move in a longitudinal
direction of said shaft sleeve, said guide means being constructed of its
5 components which are provided in both an inner wall of said shaft sleeve
and said cylindrical cam follower;

 said
resilient means for urging ~~said~~ cam follower rearward, said
resilient means being provided in front of said cylindrical cam follower;
and
10 a driving means for driving said threaded rod, said driving
means being provided inside said rotary control sleeve.

2. A liquid applicator according to claim 1, wherein: a plurality
of said rear-end projections of said cylindrical cam follower are provided.

15 3. A liquid applicator according to either of claims 1 and 2,
wherein: said driving means for driving said threaded rod comprises a
threaded hole in said rotary control sleeve, said threaded hole being a
through-hole.

20 4. A liquid applicator according to either of claims 1 and 2,
wherein: said driving means for driving said threaded rod comprises a
separate member having a female screw which is threadably engaged with
said male screw of said threaded rod, said separate member being fixedly
25 mounted inside said rotary control sleeve.

- 1 5. A liquid applicator according to any preceding claim, wherein:
a plurality of said rigid cam projections of said rotary control sleeve are
provided.
- 5 6. A liquid applicator according to any preceding claim, wherein:
said guide means for guiding said cylindrical cam follower comprises a
groove in an inner wall of said shaft sleeve and a projection in an outer
peripheral surface of said cylindrical cam follower.
- 10 7. A liquid applicator according to any one of claims 1 to 5,
wherein: said guide means for guiding said cylindrical cam follower
comprises a projection in an inner wall of said shaft sleeve and a groove in
an outer peripheral surface of said cylindrical cam follower.
- 15 8. A liquid applicator according to any preceding claim in the
form of a writing or painting instrument or a cosmetics applicator.
9. A liquid applicator according to any preceding claim
substantially as herein described.
- 20 10. A liquid applicator substantially as herein described with
reference to the accompanying drawing.
11. Each and every novel feature and combination of features
25 substantially as herein disclosed.